REMARKS

Introduction

Upon entry of the foregoing amendment, claims 1-18 and 20-21 are pending in the application. Claims 17 and 18 are currently amended. No new matter is being presented. In view of the following remarks, reconsideration and allowance of all the pending claims are requested.

Entry of this Amendment is proper under 37 C.F.R. §1.116 because the claim amendments: (a) place this application in condition for allowance (for the reasons discussed herein), (b) do not raise any new issues requiring further search and/or consideration (since the amendments amplify issues previously discussed throughout prosecution as indicated in the Final Office Action), (c) present the rejected claims in better form for consideration on appeal (should an appeal be necessary), and (d) are necessary and were not earlier presented because they are made in response to arguments raised in the Final Office Action.

Accordingly, for at least the reasons discussed above, entry of this Amendment is respectfully requested.

Rejection under 35 USC §103

Claims 1, 3-9, 11-17, 18, 20 and 21 have been rejected under 35 U.S.C. §103(a) as being unpatentable over "New Frame Rate Up-Conversion Using Bi-Directional Motion Estimation," 2000, IEEE, Choi et al. (hereinafter "Choi") in view of "Wavelet-Based Very Low Bit-Rate Video Coding Using Image Warping And Overlapped Block Motion Compensation," 2001, IEEE Heising et al. (hereinafter "Heising"). Applicants traverse this rejection for at least the following reasons.

Independent claim 1:

With respect to independent claim 1, on page 3 of the Office Action dated September 5, 2008, the Examiner alleges that Choi discloses all the limitations recited in this claim, except for admitting that Choi does not disclose the following "1) allocating a predetermined weight to the first and second interpolation pixels according to relative locations where the first and second interpolation pixels are interpolated, among the current blocks to be interpolated; 2) a motion analyzer to analyze the estimated motion vectors of the current block and the peripheral blocks are continuous; 3) a final interpolation pixel selector to select according to the result determined at the motion analyzer."

However, the Examiner further alleges that Heising discloses the limitations which are lacking in Choi, stating at page four of the Office Action: "Heising teaches allocating a predetermined weight to the first and the second interpolation pixels according to relative locations where the first and the second interpolation pixels are interpolated, among the current blocks to be interpolated. (Heising, page 95, left-hand side, lines 15-21, page 95, Fig. 2a and equation 3)."

The Examiner also alleges that Heising teaches "a motion analyzer to analyze the estimated motion vectors of the current block and the peripheral blocks 9 (Heising, page 95, right column. Lines 29-34, page 95, equation 4), and to determine whether the current block and the peripheral blocks are continuous; and a final interpolation pixel selector to select according to the result determined at the motion analyzer (Heising, page 95, right column, lines 35-36 and according to page 99, right column, lines 12-18 and page 100, left column, first paragraph)." Applicants submit that such a combination would not have been obvious and would be improper, for at least the following reasons.

Choi discloses a frame rat up-conversion algorithm for high quality video. Bi-directional motion estimation (ME) is performed to construct a motion vector field for interpolating a frame. This technique avoids overlapped pixel and hole regions in the interpolated frame and so the Overlapped Block Motion Compensation (OBMC) may be used on blocking artifacts.

Heising discloses a system for motion compensation utilizing an image warping technique in complementary fashion with OBMC. That is to say the warping model is used so

long as no blocking artifacts are detected. When blocking artifacts are found, the OBMC
technique is used instead.

Although the Examiner referred to equation 12 of Choi (weight is 0.5) as Applicants'
interpolation pixel, Choi's equation 12 does not show Applicants' candidate interpolation pixel.
Accordingly, Choi and Heising do not teach or suggest, whether alone or in combination, all of
the limitations recited in claim 1. In particular, neither Choi nor Heising teach or suggest,
whether alone or in combination, "calculate a candidate interpolation pixel by allocating a
predetermined weight to the first and second interpolation pixels according to relative locations
where the first and the second interpolation pixels are interpolated." The Examiner alleged on
page 4 of the Office Action, as previously noted above, that Heising teaches allocating a
predetermined weight to the first and second interpolation pixels according to different locations,
citing page 95 of Heising, on page 4 of the Office Action, left-hand column, lines 15-21.

Yet in all the cited language on page four of the Office Action, there is no mention of
"first and second interpolation pixels." In fact, there is no mention of interpolation pixels at all,
as required by claim 1. Also, there is no weighting "according to relative locations." Rather the
left-hand column of page 95 of Heising at lines 15-21 and formula (3) is disclosing using OBMC
with a very different technique. Heising is using intensity values (p. 95, left column, lines 19-20)
with predicted values based on motion vectors (p. 95, left column, lines 21-24). As previously
noted, the Examiner has also admitted that Choi does not satisfy this claim requirement either,
at page three of the Office Action.

Accordingly, Applicant respectfully submits that the Examiner has not met the burden of
establishing a prima facie case of obviousness as set forth in MPEP § 2143.03, portions of
which are cited as follows: "[t]o establish *prima facie* obviousness of a claimed invention, all the
claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180
USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of
that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA
1970). If an independent claim is no obvious under 35 U.S.C. 103, then any claim depending
therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)."

As the Examiner is aware, "If proposed modification would render the prior art invention

being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Moreover, "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). Thus, it is respectfully submitted that since the Examiner's proposed modification would require changing a fundamental operating principle of Heising, namely the use of formula (3) or a facsimile as disclosed in Heising, the subject claim is not made *prima facie* obvious by the cited references. Accordingly, withdrawal of the rejection and allowance of independent claim 1 are earnestly solicited.

Independent claim 9:

With respect to independent claim 9, the Examiner rejected it at page two of the Office Action, with precisely the same analysis as given for rejecting claim 1. Applicants respectfully disagree with this rejection for at least the following reasons.

Based on at least the points provided above with respect to claim 1, it is respectfully submitted that since Choi and Heising do not teach or disclose, either separately or in combination, all of the elements set forth in independent claim 9, this claim is patently distinguishable over Choi in view of Heising. In particular, Choi and Heising do not teach or disclose "calculating a candidate interpolation pixel by allocating a predetermined weight to the first and the second interpolation pixels according to relative locations where the first and the second interpolation pixels are interpolated," as required by claim 9. Accordingly withdrawal of this rejection and allowance of the claim is earnestly solicited.

Independent claim 17:

Applicants have amended claim 17 in order to more clearly and particularly point out the general inventive concept. Support for this amendment is found, for example, in the original presentation of claim 18 as well as the specification at paragraph [0015], in the Summary of the Invention.

With respect to independent claim 17, the Examiner rejected it at page two of the Office

Action, with analysis given on page eight of the Office Action. Applicants respectfully disagree with this rejection for at least the following reasons.

Based on at least the points provided above with respect to claim 1, it is respectfully submitted that since Choi and Heising do not teach or disclose, either separately or in combination, all of the elements set forth in independent claim 17, this claim is patently distinguishable over Choi in view of Heising. In particular, Choi and Heising do not teach or disclose "calculating a candidate interpolation pixel by allocating a predetermined weight to a first interpolation pixel and a second interpolation pixel according to relative locations where the first and the second interpolation pixels are interpolated," as required by claim 17. Accordingly withdrawal of this rejection and allowance of the claim is earnestly solicited.

Dependent claims 3-8, 11-16, 18, 20 and 21:

The Examiner rejected dependent claims 3-8, 11-16, 18, 20 and 21 at page two of the Office Action, with analysis from pages five to eleven. With regard to the dependent claims listed immediately above, it is respectfully submitted that for at least the reason that these claims depend respectively from independent claims 1, 9 and 17 which are allowable over the prior art for at least the reasons provided above, and therefore contain each of the features as recited in the independent claims 1, 9 and 17, the above-mentioned dependent claims are also allowable over Choi in view of Heising. Accordingly, withdrawal of these rejections and allowance of the claims are earnestly solicited.

Claims 2 and 10 have been rejected under 35 U.S.C. §103(a) as being anticipated by Choi and Heising and further in view of J. R. Ohm (hereinafter "Ohm"). Applicants traverse this rejection for at least the following reasons.

Claim 2:

With respect to claim 2, it is respectfully submitted that for at least the reason that this claim depends from independent claim 1, which is allowable for at least the reasons provided above, and therefore contains each of the features as recited in claim 1, dependent claim 2 is also allowable over Choi in view of Heising and further in view of Ohm.

Claim 10:

With respect to claim 10, it is respectfully submitted that for at least the reason that this claim depends from independent claim 9, which is allowable for at least the reasons provided above, and therefore contains each of the features as recited in claim 1, dependent claim 2 is also allowable over Choi in view of Heising and further in view of Ohm.

RESPONSE TO ARGUMENTS

1. Examiner's Argument:

The limitations of the amended independent claim [17] are met by the combination of Choi and Heising wherein the selecting of the areas of the image blocks comprises selecting discontinuous area between blocks as shown on page 93, lines 5 to 14 on the right-hand side of the Heising reference (as previously discussed in former claim 19).

Applicants' Reply:

The limitations of claim 17 currently include "calculating a candidate interpolation pixel by allocating a predetermined weight to a first interpolation pixel and a second interpolation pixel according to relative locations where the first and the second interpolation pixels are interpolated." The Examiner admits this limitation is not satisfied by Choi, at page 10 of the Office Action. Examination of page 95 (left column) of Heising demonstrates that there is no disclosure regarding "first and second interpolation pixels." In all the cited language on page four of the Office Action, there is no mention of "first and second interpolation pixels." In fact, there is no mention of interpolation pixels at all, as required by claim 17. Also, there is no weighting "according to relative locations." Rather the left-hand column of page 95 of Heising at lines 15-21 and formula (3) is disclosing using OBMC with a very different technique. Heising is using intensity values (p. 95, left column, lines 19-20) with predicted values based on motion vectors (p. 95, left column, lines 21-24).

2. Examiner's Argument:

Figure 1 which illustrates "a spatial interpolation of motion vectors" and Figure 2 which

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shows "2-D weighting function for OBMC-based prediction."

Applicants' Reply:

The Examiner has offered FIGS. 1 and 2 of Heising in response. Applicants respectfully request the Examiner to point out specifically in FIG. 1 or 2 of Heising, where "allocating a predetermined weight to the first and the second interpolation pixels, according to relative locations where the first and second interpolation pixels are interpolated" occurs. FIG. 1 of Heising appears to illustrate interpolation of motion vectors rather than "first and second interpolation pixels," as required by claims 1, 9 and 17. See Heising, page 94, right column, lines 14-17 and Equation 1.

FIG.2 of Heising appears to illustrate "cosine weighted windows" (see Heising, page 94, left column, lines 18-19) as opposed to "allocating a predetermined weight to the first and the second interpolation pixels," as required by claims 1, 9 and 17.

3. Examiner's Argument:

The decision whether to use warping prediction or OBMC for a block, which depends on whether the blocks are continuous, depends on equation 4 of the Heising reference. Also, on page 93, right column, first paragraph, Heising discusses how "motion discontinuities are not well represented in the image warping model" and how OBMC "offers an instrument for a better prediction by means of a superposition of overlapping displaced blocks from the reference frame."

Applicants' Reply:

Applicants agree that the decision whether to use warping prediction or OBMC for a particular block, depends on whether the blocks are continuous.

4. Examiner's Argument:

The result of the motion analysis is also used to select between OBMC and BMC as shown on page 100, left column, first paragraph of the Heising reference.

Applicants' Reply:

Applicants respectfully disagree with the Examiner's interpretation. There is nothing to

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suggest the abandonment of the two-tiered system of bilinear warping and OBMC. Quoting directly from Heising, page 100, left column, lines 4-6:

"Combining OBMC with BMC or bilinear warping with BMC (bmc_obmc, bili_bmc) leads to worse predictions,"

5. Examiner's Argument:

Figure 1 which illustrates "spatial interpolation of motion vectors" and Figure 2 which shows a "2-D weighting function for OBMC-based prediction."

Applicants' Reply:

See Applicants' reply to Examiner's Argument #2.

6. Examiner's Argument:

The decision whether to use warping prediction or OBMC for a block, which depends on whether the blocks are continuous, depends on equation 4 of the Heising reference. Also, on page 93, right column, first paragraph, Heising discusses how "motion discontinuities are not well represented in the image warping model and how OBMC "offers an instrument for a better prediction by means of a superposition of overlapping displaced blocks from the reference frame."

Applicants' Reply:

See Applicants' Reply #3.

7. Examiner's Argument:

The result of the motion analysis is also used to select between OBMC and BMC as shown on page 100, left column, first paragraph of the Heising reference.

Applicants' Reply:

See Applicants' reply to Examiner's Argument #4.

8. Examiner's Argument:

Equation 4 on page 95 of the Heising reference is used in the decision on whether to

use warping prediction or OBMC for a block, which depends on whether the blocks are continuous, depends on equation 4 of the Heising reference. Also, on page 93, right column, first paragraph, Heising discusses how "motion discontinuities are not well represented in the image-warping model" and how OBMC "offers an instrument for a better prediction by means of a superposition of overlapping displaced blocks from the reference frame." OBMC is used, in the presence of motion discontinuities, to reduce blocking artifacts. Applicant is also directed to page 93, left column, last paragraph to right column, first paragraph and page 95, left column lines 11-21, wherein OBMC is used in the presence of discontinuities.

Applicants' Reply:

See Applicants' Reply #3.

9. Examiner's Argument:

Applicant is directed to page 96, right column, paragraph 3, where after a quadtree block segmentation for every subblock the motion model to be used is refined, thereby some previously unselected blocks (for OBMC) will be selected for OBMC.

Applicants' Reply:

Applicants would submit that there is no teaching to suggest that the technique described in Heising is performed to reduce blurring.

10. Examiner's Argument:

Applicant is directed to page 93, right column, lines 5-14 of the Heising reference and also on page 93, left column, last paragraph to right column, first paragraph and page 95, left column lines 11-21, wherein OBMC is used, in the presence of motion discontinuities.

Applicants' Reply:

See Applicants' Reply #3.

Conclusion

Serial No.: 10/823,674
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Amendment After Final dated November 5, 2008
Reply to the Final Office Action of September 5, 2008

It is respectfully submitted that a full and complete response has been made to the outstanding Office Action and, as such, there being no other objections or rejections, this application is in condition for allowance, and a notice to this effect is earnestly solicited.
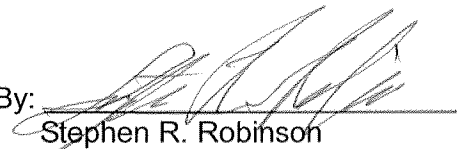
If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided below.

If any further fees are required in connection with the filing of this amendment, please charge the same to out Deposit Account No. 502827.

Respectfully submitted,

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